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CERTIFICATE OF MAILING BY FIRST CLASS MAIL (37 CFR 1.8) Applicant(s): **Kinnard et al.**			Docket No. **00-SM5-0142**	
Application No. **10/071,908**	Filing Date **February 8, 2002**	Examiner **Zervigon, Rudy**	Customer No. **23413**	Group Art Unit **1763**

Invention: **REACTOR ASSEMBLY AND PROCESSINF METHOD**

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TRANSMITTAL OF APPEAL BRIEF (Large Entity)

Docket No.
00-SM5-0142

In Re Application Of: **Kinnard et al.**

Application No.	Filing Date	Examiner	Customer No.	Group Art Unit	Confirmation No.
10/071,908	**February 8, 2002**	**Zervigon, Rudy**	**23413**	**1763**	**2272**

Invention: **REACTOR ASSEMBLY AND PROCESSING METHOD**

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Peter R. Hagerty
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00-SM5-142

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Appellants:	Kinnard et al.	)	
		)	Group Art Unit: 1763
Serial No.:	10/071,908	)	
		)	
Filed:	February 8, 2002	)	Examiner: Zervigon, Rudy
		)	
For:	REACTOR ASSEMBLY AND PROCESSING METHOD	)	
		)	

Assistant Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

SUPPLEMENTAL APPEAL BRIEF

05/30/2006 HDESTA1 00000043 061130 10071908
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I. REAL PARTY IN INTEREST

The real party in interest in this Appeal is Axcelis Technologies, Inc.

II. RELATED APPEALS AND INTERFERENCES

There are no related appeals or interferences known to Appellants, Appellants' legal representatives, or assignee that will directly affect, be directly affected by, or have a bearing on the Board's decision in the pending appeal.

III. STATUS OF THE CLAIMS

Claims 1-21 and 32-36 are pending in the application and stand finally rejected. Claims 1-21 and 32-36, as they currently stand, are set forth in Section IX below.

The Office Action dated March 21, 2006 attempts to reopen prosecution by substantially maintaining the same rejections that served as the basis for Applicants' original Appeal. The Office Action now includes in its various 103 rejections U.S. Patent No. 5,091,207 to Tanaka. Appellants hereby maintain the appeal and will address the new grounds of rejection applied to Claims 1-21 and 32-36 in the most recent Office Action.

IV. STATUS OF THE AMENDMENTS

No amendments have been filed subsequent to the final rejection dated June 20, 2005. All prior amendments have been entered.

V. SUMMARY OF CLAIMED SUBJECT MATTER

The claimed invention is generally directed to cross flow reactor assemblies. In independent Claim 1, and as is generally shown in Figures 1 and 2, the reactor assembly (10) comprises a base unit (14); a chuck assembly (20); a process chamber (40); an inlet manifold assembly (60); and an exhaust manifold assembly (80). The base unit (14) is described in greater detail at paragraph [0036] and is shown in Figure 4; and the chuck assembly (20) is described in greater detail at paragraphs [0037]-[0040] and a detailed exploded view of the

chuck assembly can be found in Figure 5. The process chamber (40) is described in detail at paragraphs [0041] – [0043] and is clearly shown in Figures 1, 2, and 9. The inlet manifold assembly (60) is described in detail at paragraphs [0044]-[0046] and is shown in Figures 10-12. The exhaust manifold assembly (80) is described in detail at paragraphs [0047]-[0050] and is shown in Figures 13-18.

The chuck assembly (20) is disposed in a cavity (18) of the base unit and comprises a support (22) having a surface capable of receiving a substrate.

The process chamber (40) as presented in Claim 1 comprises a top wall (42), a bottom wall, and sidewalls (44) extending therefrom substantially perpendicular to the support surface (22) of the chuck assembly (20), and a cylindrical opening extending through the bottom wall to the top wall defining a substantially cylindrically shaped interior region (see Figure 9) having a central axis extending substantially perpendicular to the support surface of said chuck assembly (20). The process chamber is coupled to the base unit.

The claimed inlet manifold assembly (60) is in fluid communication with a first sidewall opening (48) of the process chamber (40) in a selected one of the sidewalls (44) and comprises a flow-shaping portion (64) adapted to laterally elongate a gas and/or a reactant flow into the process chamber (40). The fluid communication between the inlet manifold assembly (60) and the first sidewall opening (48) of the process chamber is free from a baffle plate.

The exhaust manifold assembly (80) is in fluid communication with a second sidewall opening (50) of the process chamber (40) in the sidewall (44) diametrically opposed from the selected one of the sidewalls, wherein the first and second sidewall openings (48, 50) define an entire flow path of the gas and/or the reactant flow into and out of the process chamber (40).

In independent Claim 32, the top wall (42) of the process chamber (40)is transparent and the reactor assembly further comprises a light source assembly (100) in operable

communication with the transparent top wall (42) for projecting radiation into the process chamber.

The claimed cross flow reactor assemblies permit a reaction to proceed at a faster rate than conventional axial flow reactors while providing control of the substrate temperature. Since chamber volume is relatively small in the claimed cross flow configuration, residence time is minimized. Moreover, the lack of a baffle plate at the gas inlet advantageously reduces the effect of recombination of active species by reducing the surface area in contact with the gas and reducing pressure variations upstream of the wafer. Other advantages include, but are not limited to, elimination of parasitic wafer heating or so-called "first wafer" effects normally found in baffle plate equipped axial flow reactors; higher strip rates than conventional axial flow reactors; lower manufacturing costs due to a simpler design; elimination of quartz or aluminum alloys and coatings used for inlet gas distribution; and smaller footprint due to the decreased size and vertical height. The reactor assembly is versatile and can be readily adapted for a variety of applications.

VI. NEW GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

1. Whether Claims 1-4, 6, 10-16, 21, and 32-36 are properly rejected under 35 U.S.C. § 103(a), as allegedly unpatentable over U.S. Patent No. 6,143,079 to Halpin et al. (hereinafter "Halpin") and U.S. Patent No. 5,091,207 to Tanaka (herein after "Tanaka") in view of U.S. Patent No. 5,077,875 to Hoke et al. (hereinafter "Hoke").

2. Whether Claim 5 is properly rejected under 35 U.S.C. § 103(a), as allegedly unpatentable over Halpin, Tanaka, and Hoke in view of the STIC translation of JP 02-152251 to Takagi et al. (hereinafter "Takagi").

3. Whether Claims 7, and 17-19 are properly rejected under 35 U.S.C. § 103(a), as allegedly unpatentable over Halpin, Tanaka, and Hoke in view of U.S. Patent No. 5,190,592 to Chazee et al. (hereinafter "Chazee").

4. Whether Claims 8 and 9 are properly rejected under 35 U.S.C. § 103(a), as allegedly unpatentable over Halpin, Tanaka, and Hoke in view of U.S. Patent No. 6,583,638 to Costello et al. (hereinafter "Costello").

5. Whether Claim 20 is properly rejected under 35 U.S.C. § 103(a), as allegedly unpatentable over Halpin, Tanaka, Hoke, and Chazee in view of U.S. Patent No. 6,355,108 to Won et al. (hereinafter "Won").

VII. ARGUMENTS

1. Claims 1-4, 6, 10-16, 21, and 32-36 were improperly rejected under 35 U.S.C §103(a) and are patentable over Halpin and Tanaka in view of Hoke.

Halpin is generally directed to a process chamber that includes a system of multiple gas ports, which are characterized as being critical for providing improved gas flow through the described process chamber. Generally, the process chamber as described includes an inlet port, a primary outlet port, a first side outlet port and a second side outlet port. The side outlet ports are opposite each other and approximately 90 degrees from the inlet and primary outlet ports. It should also be noted that Halpin describes the use of a gas injector (see Halpin, Col. 11, ll., 16-21) for injecting the gases into the inlet port. The gas injector injects gases in a direction transverse to the longitudinal direction of the flow of gases from the inlet port to the outlet ports.

Hoke is generally directed to a horizontal metallorganic chemical vapor deposition reactor vessel (MOCVD) including an elongated rectangular shaped processing chamber. To obtain its desired flow pattern, Hoke requires a baffle plate disposed adjacent to the inlet port to allegedly increase uniformity and decrease turbulence of a vapor stream flowing through the chamber. A block is also disposed within the chamber, which is positioned between the baffle plate and a substrate support assembly. The chamber itself includes a rather spacious interior region to house the baffle plate, block, substrate support, and also provides a space intermediate the exhaust portion and the support. A RF coil is disposed about the external periphery of the process chamber and provides inductive heating of the substrate during

operation thereof.

Tanaka is generally directed to a chemical vapor deposition process and apparatus. The apparatus can be one of many types including vertical type reactors, barrel type reactors, pancake type reactors, and horizontal type reactors. Tanaka comments in its background section that uniform flow of reactant gases into the reaction furnace of any CVD apparatus is extremely important to obtain a uniformly deposited layer or film. According to Tanaka, deposition uniformity depends significantly on the uniformity of the exhausting of a used gas through a plurality of exhaust ports. (see Tanaka, Col. 1, ll. 27-33). The apparatus and process of Tanaka includes flowing the exhaust through multiple exhaust ports radially disposed around an axis of flow so as to overcome some of the problems associated with mass flow controllers and improve uniformity.

To establish a *prima facie* case of obviousness, the Examiner must meet the burden of establishing (1) that the prior art relied upon, coupled with knowledge generally available in the art at the time of the invention, must contain some suggestion or incentive that would have motivated the skilled artisan to modify a reference or to combine references; (2) that the proposed modification of the prior art must have had a reasonable expectation of success, determined from the vantage point of the skilled artisan at the time the invention was made; and (3) that all elements of the claimed invention are disclosed in the prior art. *In re Vaeck*, 947 F. 2d 488, 20 U.S.P.Q.2d 1438 (Fed. Cir. 1991).

Under the first element, to establish *prima facie* obviousness of a claimed invention, the proposed modification cannot render the prior art unsatisfactory for its intended purpose. If the proposed modification would render the prior art invention being modified unsatisfactory for its intended purpose, then there is no suggestion or motivation to make the proposed modification. *In re Gordon*, 733 F.2d 900, 221 USPQ 1125 (Fed. Cir. 1984).

In each one of Applicants' independent claims, the claimed reactor assembly comprises, *inter alia*, first and second sidewall openings that define an entire flow path of the gas and/or the reactant flow into and out of the process chamber. In contrast, Halpin teaches and suggests a process chamber that includes a multiple port system, i.e., an inlet port, a

primary main port, a first side outlet port, and a second side outlet port. These ports are necessary so as to provide "improved gas flow". In fact, Halpin in its detailed description labels a section as "Inlets and Outlets for Improved Gas Flow" (see Halpin at Column 10, line 33), using the plural form to characterize "outlets". Immediately after the section heading, Halpin discloses that "[t]he preferred chamber provides improved gas flow distribution by employing ***multiple ports*** (emphasis added), (see Halpin at Col. 10, ll. 34-35). Specifically, the outlet ports are "symmetrically distributed in the chamber to facilitate uniform, laminar flow, and reduce recirculations." (see Halpin,. Col. 10, ll. 39-41). Tanaka also teaches and suggests a multiple port exhaust system. The multiple port exhaust system is radially disposed around the axis of reactant flow into the reactor. Moreover, the multiple ports are characterized as being symmetrical with respect to the plane that contains the flow axis and at a uniform distance from the axis (see Tanaka, Figure 4 as well as the discussion at Col. 2, ll. 54-63 and Col. 3, ll. 15-37).

If Halpin and Tanaka were modified to have first and second sidewall openings that define the entire flow path of the gas and/or the reactant flow into and out of the process chamber as claimed by Applicants, the intended purpose of Halpin as well as Tanaka would be destroyed. Halpin and Tanaka are explicit in their teachings that their process chambers have multiple outlet (i.e., exhaust) ports to provide the desired gas and/or reactant flow through the process chamber. Halpin's intended purpose is to have the gases spread out across the wafer being processed. The proposed modification with Hoke to minimize the multiple outlet ports to a single main outlet and a single inlet would render the Halpin invention unsatisfactory for its intended purpose and runs counter to that taught by Halpin as essential. For example, according to Halpin:

> [b]y providing side gas outlets 26 and 28, in addition to the main gas outlet 24, gas distribution within the chamber can be controlled to provide gas flow toward the sides of the chamber where side outlet ports are located, as well as generally downstream direction toward the main outlet.

(Halpin, Col. 14, ll. 43-48)

> Furthermore, by improving gas flow in this manner, the chamber 10 can be made more compact than previously designed chambers because the

> reactant gases do not require additional space to spread out toward the sides of the chamber before reaching then wafer.

(Halpin, Col. 14, ll. 51-55)

Thus, modifying the multiple outlet ports (which is a critical necessity to the gas flow properties provided by Halpin's multiple outlet port process chamber and is also what Halpin teaches as a whole) in the manner suggested by Hoke would render the Halpin invention unsatisfactory for its intended purpose. Moreover, the proposed modification would change the flow pattern as described by Halpin and would likely deleteriously affect uniformity.

For similar reasons, modifying Tanaka to minimize the multiple exhaust ports to a single main outlet would render the Tanaka invention unsatisfactory for its intended purpose and runs counter to that taught by Tanaka as being essential. Tanaka, throughout its specification, teaches and suggests the need for flowing the exhaust through multiple exhaust ports radially disposed around an axis of flow to improve deposition uniformity. Essentially, this is the invention of Tanaka and is critical to its process to control uniformity.

It is unclear as to why the Examiner even included Tanaka in its combination of references. The section referred to by the Examiner as providing support for his obviousness rejection explicitly states the need for multiple exhaust ports. It is also clearly shown in Figure 4, which the Examiner also refers to as evidence of support.

> FIG. 4 shows a part of a vertical type CVD apparatus according to the present invention. As shown in the figure, a reaction furnace or chamber 10 is provided with an inlet 20 for reactant gases in the upper portion thereof and ***four exhaust ports 31, 32, 33, and 34*** in the lower portion thereof, and contains a susceptor 25 therein. The exhaust ports 31 to 34 are disposed radially around an axis "a" of a flow of the reactant gas introduced into the furnace, at a uniform distance from the axis "a", and with a uniform distance "S" between neighboring ports. Exhaust pipes 41 to 44 extending from the exhaust ports 31 to 34, respectively are provided with conductance valves V1 to V4 (FIG. 4(b)), respectively. These conductance valves V1 to V4 adjust the flow quantity of the flow of used gas or exhausted gas E1 to E4 discharged from the respective exhaust ports 31 to 34. The exhausts E1 to E4 are passed through the conductance valves V1 to V4, and thereafter, are coalesced to form an exhaust E which is conducted to a not-shown exhauster.

> The conductance valve to be used in the present invention is able to adjust the flow quantity by varying the conductance of a flow path system and may be a valve such that the adjusting function thereof is not hindered by dust entrained by an exhaust flowing therethrough. Conductance valves generally used include the three types shown in FIG. 5.

(Tanaka, Col. 4, ll. 31-58, emphasis added)

Moreover, it should also be noted that Tanaka described its multiple exhaust outlets as being radially disposed about the axis flow of reactants. Thus, the outlets are perpendicular to the flow of reactants. As such, the outlet and inlet are not diametrically opposed as claimed by Applicants, which is directed to laminar flow. The configuration provided by Tanaka would be characterized as turbulent since the axial flow of reactants would impact the substrate at about 90 degrees and then flow along a plane defined by the substrate surface to the exhaust outlets, which are radially disposed and symmetrically located about the impact plane. By reducing the outlets to a single outlet in the manner suggested by Hoke would likely create even greater turbulence and non-uniformity.

In summary, modifying Halpin and/or Tanaka with Hoke is counterintuitive to what is taught by these references as a whole, which teach and require the use of multiple outlet ports for controlling uniformity. One of skill in the art would not be motivated to reduce the multiple exhaust ports in Tanaka and/or Halpin to a single port as taught by Hoke.

Moreover, it is well known that if the proposed modification or combination of the prior art would change the principle of operation of the prior art invention being modified, then the teaching of the references are <u>not</u> sufficient to render the claims *prima facie* case obvious. *In re Ratti*, 270 F. 2d 810, 123 USPQ 349 (CCPA 1959). Clearly, modifying the process chamber as taught by Halpin and Tanaka in the manner proposed by a combination with the Hoke reference would change the principle of operation. Halpin teaches and suggests a process chamber having multiple outlet ports to provide a desired laminar flow pattern into and out of the process chamber as well as provide flow toward the sides of the chamber. Tanaka also teaches the use of multiple ports that are radially disposed in a symmetrical configuration about the axial flow. By modifying Halpin and/or Tanaka to have

a single outlet port would necessarily change the principle of operation. No longer would gas flow be provided towards the sides of the chamber where the side outlet ports are located as in Halpin or to the radially disposed exhaust ports in Tanaka. Thus, it would be expected based on the teachings of Halpin and Tanaka provided as a whole that uniformity would suffer if the process chamber were limited to a single outlet. Moreover, it would no longer be feasible, based on the teachings provided therein, to provide a process chamber having a compact design because now additional space would be require to allow the lateral flow of the gases. Hoke, doesn't appreciate this problem since it is a MOCVD with ample space within the interior region of its elongated process chamber. For at least these reasons alone, the cited combination of Halpin and Tanaka with Hoke does not establish a *prima facie* case of obviousness against Claims 1-4, 6, 7, 10-16, 21, and 32-36.

With regard to the second element required to establish *prima facie* obviousness, the proposed modification of the prior art must have had a reasonable expectation of success, determined from the vantage point of the skilled artisan at the time the invention was made. Here, there is no reasonable expectation of success. The primary references, Halpin and Tanaka, teach and suggest a multiple outlet (exhaust) port process chamber that includes a primary main outlet port, a first side outlet port, and a second side outlet port as in Halpin or multiple exhaust ports radially disposed about the axial flow of reactants as in Tanaka. The proposed modifications to Halpin and/ Tanaka would result in a markedly different process chamber that would not enjoy the benefits disclosed by utilizing a process chamber with the side outlet ports or radially disposed multiple exhaust ports. As noted in Halpin, the side outlet ports are critical to its desired gas flow properties. Halpin suggests the elimination of the main outlet port in some embodiments, but always requires two or more side outlet ports at a minimum so as to provide gas flow toward the sides of the chamber (see Halpin, Col. 12, ll. 38-53). Similarly, Tanaka the use of multiple exhaust ports radially disposed about the axial flow. Thus, by modifying Halpin and/or Tanaka as proposed by the Examiner based on the teachings provided by Hoke would drastically change the flow properties through the process chamber and it is unlikely to have any reasonable expectation of success given the complexities in establishing a laminar flow pattern within a compact design and with uniformity.

In applying Section 103, the U.S. Court of Appeals for the Federal Circuit has consistently held that one must consider both the invention and the prior art "as a whole", not from improper hindsight gained from consideration of the claimed invention. See, *Interconnect Planning Corp. v. Feil,* 227 U.S.P.Q. 543, 551 (Fed. Cir. 1985) and cases cited therein. According to the *Interconnect* court:

> [n]ot only must the claimed invention as a whole be evaluated, but so also must the references as a whole, so that their teachings are applied in the context of their significance to a technician at the time - a technician without our knowledge of the solution.

Id. Also critical to this Section 103 analysis is that understanding of "particular results" achieved by the invention. *Id.* The present rejection clearly fails to consider what Halpin, Tanaka and Hoke teaches "as a whole" and is improperly relying on hindsight for the basis of the rejection. It is well known patent law, that when the Section 103 rejection was based on selective combination of the prior art references to allegedly render a subsequent invention obvious, "there must be some reason for the combination other than the hindsight gleaned from the invention itself." *Id.* Stated in another way, "[i]t is impermissible to use the claimed invention as an instruction manual or 'template' to piece together the teachings of the prior art so that the claimed invention is rendered obvious." *In re Fritch* 23 U.S.P.Q.2d 1780, 1784 (Fed. Cir. 1992).

As a whole, Halpin and Tanaka teach the use of multiple exhaust ports to provide a uniform flow in their particular process chamber configuration. The teachings provided in the primary references of multiple ports in process chambers have been ignored. Likewise, the teachings provided by Hoke as a whole have been ignored. Hoke is generally directed to a rectangular shaped interior region, wherein a baffle plate is disposed adjacent to an inlet to increase uniformity and decrease turbulence of a vapor stream flowing through the chamber. A block is disposed within the chamber, which is positioned between the baffle plate and a substrate support assembly. The baffle plate is <u>required</u> so that a desired laminar flow pattern for Hoke's particular reactor vessel configuration can be established. Disregarding the teaching of the baffle plate to provide its desired laminar flow, as proposed by the Examiner

in his combination of Hoke with Halpin and Tanaka, would likely render Hoke's MOCVD reactor unsatisfactory for its intended purpose. With regard to the necessity of the baffle plate Hoke comments that:

> [t]he baffle 12 is here used to diffuse an incoming vapor through inlet 14, to increase the laminar flow characteristic of said incoming vapor stream. The gas diffusing baffle 12 has a plurality of apertures or small holes 12a disposed therethrough. The holes 12a may be disposed in a pattern or random arrangement. Here the holes 12a are disposed in an ordered grid arrangement. During growth, vapor enters the reactor vessel 10 via the reactor inlet 14 (which is connected to tube portion 40g of vapor apparatus 35 of FIG. 2) at a high flow rate, approximately 10 liters/minute for example. At such flow rate, pressure builds up in the inlet area 15, behind the gas diffusing baffle 12, resulting in gas flow through all of the plurality of holes 12a of the gas diffusing baffle 12 thus providing a substantially laminar gas flow. <u>As mentioned above, the inlet area 15 is linearly tapered; however, due to the diffusion of the gas by the baffle 12 once pressure has built up in the inlet area 15, the effect of the shape of such inlet area 15 on the uniformity of the resulting gas flow, is believed to be relatively insignificant. The gas diffusing baffle 12 and the inlet area 15 in which vapor pressure builds, prevent the gas from streamlining along the center of the rectangular chamber 11. Thus, to insure laminar flow by use of the baffle 12, it is believed to be sufficient to provide any shaped inlet area 15 between the inlet 14 and the baffle 12. Such area will prevent streamlining of the vapor through the baffle 12.</u> Thus, the baffle 12 is disposed adjacent to but spaced from the inlet 14 of the reactor vessel 10. In applications where the width of the chamber 11 is increased due to an increase in the substrate 63 size, but the size of the inlet 14 remains the same, the streamlining effect will be more significant, emphasizing the <u>importance of such a baffle 12</u>.

(Hoke, carryover paragraph of Cols. 7-8, Emphasis added)

Thus, without the baffle plate, the laminar flow characteristics of the incoming vapor stream would deleteriously decrease. As such, any combination of references that include the teachings provided by Hoke would require the use of the baffle plate adjacent to the inlet portion. Applicants' claimed reactor assembly is free of a baffle plate at the inlet. The Examiner is believed to be using the claimed invention as an instruction manual or 'template' to piece together the teachings of the prior art so that the claimed invention is rendered obvious, which is clearly improper.

Purportedly, motivation for first combining Halpin with Hoke was to combine Hoke's flow shaping portion with Halpin's manifold assembly to arrive at Applicants' claimed invention (see Office Action dated June 20, 2005, page 14, ll7-11). Clearly, Hoke's flow shaping portion includes the baffle plate at the inlet portion as well as the block disposed between the baffle plate and a substrate to be processed. This is what Hoke teaches as a whole as it relates to the flow-shaping portion. Since Halpin is directed to a markedly different process chamber of a compact design, it is submitted that the flow shaping portion would not fit within the confines of Halpin's process chamber as described. With regard to Tanaka, this primary reference is clear in its teachings that multiple exhaust ports are radially disposed about the axial flow of reactants. In view of the foregoing, it is submitted that the Examiner is improperly relying on hindsight by taking selected portions of Hoke's flow shaping portion and combining this with selected portions of Halpin and Tanaka to purportedly arrive at Applicants' claimed invention.

Finally, with regard to the third element that is required to establish *prima facie* obviousness, it is submitted that all features of the claimed invention are not disclosed in the prior art. In each one of Applicants' independent claims, the claimed reactor assembly comprises, *inter alia*, first and second sidewall openings that define the entire flow path of the gas and/or the reactant flow into and out of the process chamber. Halpin and/or Tanaka fail to teach or suggest this feature and for reasons previously discussed, whereas modification in accordance with the teachings provided by Hoke is clearly improper. Moreover, even if Halpin and Tanaka were modified to provide the claimed flow path, which it cannot, Hoke teaches a flow shaping portion that includes the use of a baffle plate. Applicants claimed reactor assemblies are free of a baffle plate. Therefore, because all of the elements of independent claims 1 and 32 are not taught in Halpin, or Hoke, there is no *prima facie* obviousness.

In view of the foregoing, it is therefore respectfully submitted that the rejection to Claims 1-4, 6, 10-16, 21, and 32-36 is improper and is requested to be withdrawn.

2. Claim 5 was improperly rejected under 35 U.S.C 103(a) and is patentable over Halpin, Tanaka, and Hoke in view of the STIC translation of JP 02-152251 to Takagi.

Claim 5 is dependent on the reactor assembly of Claim 1, wherein a bottom wall of the base unit is adapted to be stackedly attached to a second reactor assembly.

Halpin, Tanaka, and Hoke are discussed above.

Takagi is generally directed to a vertical semiconductor manufacturing system that includes multiple vertically stacked process chambers. Pairs of process chambers are piled along the vertical direction to minimize the clean room footprint. Takagi fails to compensate for any of the deficiencies resulting from the combination of Halpin, Tanaka, and Hoke as noted above.

Moreover, it is noted that Hoke teaches wrapping an RF coil about its process chamber such that the stacking of multiple process chambers would be prevented. Still further, the drive mechanism in Hoke for the rotating support is positioned underneath the process chamber. The drive mechanism requires a drive shaft (see Hoke, Figure 4, Ref. No. 22) to effect rotation of the support platen. Thus, the drive mechanism as suggested by Hoke would also prevent stacking multiple process chambers. Again, it is believed that the Examiner is improperly relying on hindsight by picking and choosing various elements as he deems fit. In view of these differences, a combination of the cited references would fail to establish a *prima facie* case of obviousness and would likely not provide any reasonable expectation of success.

Favorable reconsideration of Claim 5 is requested.

3. Claims 7, and 17-19 were improperly rejected under 35 U.S.C 103(a) and are patentable over Halpin, Tanaka, and Hoke in view of Chazee.

Halpin, Tanaka, and Hoke are discussed above.

Chazee is generally directed to an aerosol injection system. The aerosol injection system produces composite layers by the pyrolysis of solutes on heated substrates traveling in the muffle of a furnace. The furnace is described as having a parallelpipedic vertical case, which is used for channeling aerosol from its arrival at the top down to its base. The Examiner relies on Chazee to purportedly teach Applicants' claimed exhaust assembly as defined in dependent claims 7, 10, and 17-19.

Applicants first traverse the rejection on the grounds that Chazee is non-analogous art. For the purposes of evaluating obviousness of claimed subject matter, the particular references relied upon must constitute "analogous art". *In re Clay*, 966 F.2d 656, 659, 23 U.S.P.Q.2d 1058, 1060-61 (Fed. Cir. 1992). The art must be from the same field of endeavor, or be reasonably pertinent to the particular problem with which the inventor is involved. *Id.* As noted above, Chazee discloses an aerosol injection system that includes flowing solutes within a furnace in a vertical direction. This is not from the same field of endeavor nor is it closely related to the particular problem to which Applicants claims are directed.

Secondly, there is no motivation to combine this reference with Halpin, Tanaka, and Hoke. Again, it is apparent that the Examiner is failing to consider the teachings provided in each reference as a whole and is improperly relying on hindsight using Applicant's claimed invention as a template. Chazee is directly to the vertical flow of solutes through its aerosol injection system. This is markedly different from Applicants claimed cross flow reactor assemblies that provide improved cross flow uniformity, among others.

Thirdly, it is submitted that Chazee fails to compensate for the deficiencies of Halpin, Tanaka, and Hoke. For reasons discussed above, there is not teaching or suggestion of a reactor assembly comprising, *inter alia*, first and second sidewall openings that define the entire flow path of the gas and/or the reactant flow into and out of the process chamber, wherein the first sidewall opening is free of a baffle plate.

In view of the foregoing, the rejection of Claims 7 and 17-19 should be withdrawn.

4. Claims 8 and 9 were improperly rejected under 35 U.S.C 103(a) and are patentable over Halpin, Tanaka, and Hoke in view of Costello.

Halpin, Tanaka, and Hoke are discussed above.

Costello is generally directed to a temperature controlled wafer chuck system.

Claims 8 and 9 depend from Claim 1 and as such, include all of the limitations found in the base claim. For reasons previously discussed, Halpin, Tanaka, and Hoke fail to teach or suggest a reactor assembly that comprises, *inter alia*, first and second sidewall openings that define an entire flow path of the gas and/or the reactant flow into and out of the process chamber. Costello fails to compensate for any of the deficiencies of Halpin, Tanaka, and Hoke discussed above.

Accordingly, the rejection of Claims 8 and 9 are quested to be withdrawn.

5. Claim 20 was improperly rejected under 35 U.S.C 103(a) and is patentable over Halpin, Tanaka, Hoke and Chazee in view of Won.

Halpin, Tanaka, and Hoke are discussed above.

Won is generally directed to a clamping and alignment assembly for aligning and stabilizing a substrate during processing. According to the Examiner, Won teaches and suggests fabricating the rectangular aperture taught by the combination of Halpin, Tanaka, Hoke and Chazee from anodized aluminum.

Dependent Claim 20 is directed to the reactor assembly, wherein a flow restrictor is formed of anodized aluminum and also includes the feature of first and second sidewall openings that define an entire flow path of the gas and/or the reactant flow into and out of the process chamber. A flow restrictor is affixed to an opening of the exhaust receiving portion (second sidewall opening) and is adapted to restrict the gas and/or reactant flow through the opening from the process chamber into the exhaust-receiving portion.

For reasons previously discussed, Halpin, Tanaka, Hoke and Chazee fail to teach or

suggest, individually or in combination, first and second sidewall openings that define an entire flow path of the gas and/or the reactant flow into and out of the process chamber, wherein the first opening (inlet) is free of a baffle plate. As a whole, both Halpin and Tanaka require the use of multiple exhaust ports so as to provide uniformity. Although Hoke does not employ multiple exhaust ports, Hoke does require a baffle plate at the inlet to provide control uniformity during processing in its MOCVD reactor. Chazee is directed to an aerosol system and fails to compensate for the deficiencies resulting from the combination of cited references.

Accordingly, the rejection of Claim 20 should be withdrawn.

In summary, Claims 1-21 and 32-36 are non-obvious over the art of record. For the reasons cited above, Appellants respectfully submit that all of the claims are allowable and the application is in condition for allowance. Appellants respectfully request reversal of the outstanding rejections and allowance of this application.

VIII. CLAIMS APPENDIX

1. (Rejected) A reactor assembly comprising:

a base unit;

a chuck assembly disposed in a cavity of the base unit, wherein the chuck assembly comprises a support having a surface capable of receiving a substrate;

a process chamber comprising a top wall, a bottom wall, and sidewalls extending therefrom substantially perpendicular to the support surface of said chuck assembly, and a cylindrical opening extending through the bottom wall to the top wall defining a substantially cylindrically shaped interior region having a central axis extending substantially perpendicular to the support surface of said chuck assembly , wherein the process chamber is coupled to the base unit;

an inlet manifold assembly in fluid communication with a first sidewall opening of the process chamber in a selected one of the sidewalls, wherein the inlet manifold assembly comprises a flow-shaping portion adapted to laterally elongate a gas and/or a reactant flow into the process chamber, wherein the fluid communication between the inlet manifold assembly and the first sidewall opening of the process chamber is free from a baffle plate; and

an exhaust manifold assembly in fluid communication with a second sidewall opening of the process chamber in the sidewall diametrically opposed from the selected one of the sidewalls, wherein the first and second sidewall openings define an entire flow path of the gas and/or the reactant flow into and out of the process chamber.

2. (Rejected) The reactor assembly according to Claim 1, wherein the flow-shaping portion of the inlet manifold assembly is adapted to introduce the gas and/or reactant flow into the process chamber at about a plane parallel to a surface of the substrate.

3. (Rejected) The reactor assembly according to Claim 1, wherein the flow-shaping portion is triangularly shaped.

4. (Rejected) The reactor assembly according to Claim 1, wherein the top wall of the process chamber is removable.

5. (Rejected) The reactor assembly according to Claim 1, wherein a bottom wall of the base unit is adapted to be stackedly attached to a second reactor assembly.

6. (Rejected) The reactor assembly according to Claim 1, wherein the exhaust manifold assembly is adapted to receive the gas and/or reactant flow from the process chamber at about a plane parallel to the surface of the substrate.

7. (Rejected) The reactor assembly according to Claim 1, wherein the exhaust manifold assembly comprises an exhaust receiving portion and a flow restrictor, wherein the flow restrictor is affixed to an opening of the exhaust receiving portion and is adapted to restrict the gas and/or reactant flow through the opening from the process chamber into the exhaust receiving portion.

8. (Rejected) The reactor assembly according to Claim 1, wherein the support of the chuck assembly comprises a means for regulating a temperature of the substrate.

9. (Rejected) The reactor assembly according to Claim 1, wherein the support further comprises a resistance heating element and a cooling passage.

10. (Rejected) The reactor assembly according to Claim 1, wherein the support of the chuck assembly is stationary and non-rotating.

11. (Rejected) The reactor assembly according to Claim 1, wherein the inlet manifold assembly further comprises a flow restrictor attached to an opening of the flow-shaping portion.

12. (Rejected) The reactor assembly according to Claim 1, wherein the top wall is substantially transparent to a light source.

13. (Rejected) The reactor assembly according to Claim 1, wherein the top wall is substantially transparent to a UV light source.

14. (Rejected) The reactor assembly according to Claim 1, wherein the top wall is substantially transparent to an infrared light source.

15. (Rejected) The reactor assembly according to Claim 1, wherein the process chamber includes a third sidewall opening in the sidewall adjacent to the first and second sidewall openings, wherein the third opening is sized for transporting the substrate into an interior region of the process chamber.

16. (Rejected) The reactor assembly according to Claim 1, further comprising a baffle plate disposed about an opening of the flow-shaping portion.

17. (Rejected) The reactor assembly according to Claim 7, wherein the exhaust receiving portion is triangularly shaped.

18. (Rejected) The reactor assembly according to Claim 7, wherein the flow restrictor comprises a plate having at least one passageway.

19. (Rejected) The reactor assembly according to Claim 7, wherein the flow restrictor comprises a rectangularly shaped plate having a length dimension greater than a height dimension, wherein the passageway is disposed in an area less than or equal to about one half of the height dimension.

20. (Rejected) The reactor assembly according to Claim 7, wherein the flow restrictor comprises anodized aluminum.

21. (Rejected) The reactor assembly according to Claim 1, wherein the inlet manifold assembly is adapted to introduce the gas and/or reactants at about a plane parallel to a surface of the substrate and the exhaust manifold assembly is adapted to exhaust the gas and/or reactants at about a plane parallel to a surface of the substrate.

22.-31. (Canceled)

32. (Rejected) A reactor assembly comprising:

a base unit;

a chuck assembly disposed in a cavity of the base unit, wherein the chuck assembly comprises a support having a surface capable of receiving a substrate;

a process chamber comprising a transparent top wall, a bottom wall, and sidewalls extending therefrom, and a cylindrical opening extending through the bottom wall to the top wall to define a substantially cylindrically shaped interior region, wherein the process chamber is coupled to the base unit;

a light source assembly in operable communication with the transparent top wall for projecting radiation into the process chamber;

an inlet manifold assembly in fluid communication with a first sidewall opening of the process chamber in a selected one of the sidewalls, wherein the inlet manifold assembly comprises a flow-shaping portion adapted to laterally elongate a gas and/or a reactant flow into the process chamber, wherein the fluid communication between the inlet manifold assembly and the first sidewall opening of the process chamber is free from a baffle plate; and

an exhaust manifold assembly in fluid communication with a second sidewall opening of the process chamber in the sidewall diametrically opposed from the selected one of the sidewalls, wherein the first and second sidewall openings define an entire flow path of the gas and/or the reactant flow into and out of the process chamber.

33. (Rejected) The reactor assembly of Claim 32, wherein the light source assembly comprises a housing and a light source.

34. (Rejected)The reactor assembly of Claim 32, wherein the top wall comprises a quartz material.

35. (Rejected)The reactor assembly of Claim 32, wherein the exhaust manifold assembly is adapted to receive the gas and/or reactant flow from the process chamber at about a plane parallel to a surface of the substrate.

36. (Rejected) The reactor assembly of Claim 32, wherein the transparent top wall is removable.

IX. EVIDENCE APPENDIX

There is no evidence submitted pursuant to 37 C.F.R. §1.130, 37 C.F.R. §1.131, or 37 C.F.R. §1.132 or any other evidence entered by the Examiner and relied upon by the Appellant in this appeal, known to the Appellants, Appellants' legal representatives, or assignee.

X. RELATED PROCEEDINGS APPENDIX

There are no other related appeals or interferences known to Appellants, Appellants' legal representatives, or assignee that will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

In the event the Examiner has any queries regarding the submitted arguments, the undersigned respectfully requests the courtesy of a telephone conference to discuss any matters in need of attention.

If there are any additional charges with respect to this Appeal Brief, please charge them to Deposit Account No. 06-1130.

Respectfully submitted,

CANTOR COLBURN LLP

By ______________________
Peter R. Hagerty
Registration No. 42,618

Date: May 22, 2006
CANTOR COLBURN LLP
55 Griffin Road South
Bloomfield, CT 06002
Telephone (404) 607-9991
Facsimile (404) 607-9981
Customer No. 23413